THE GOVERNANCE OF FOG AND HAZE IN CHINA

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Abstract

China has been struggling with fog and haze since 2013. Fog and haze, one of the forms of air pollution, can form out of natural reason, but in most cases, they are man-caused, by namely industrial coal emission, winter heating, and massive coal incineration. Fog and haze, however, have been not only an environmental issue but also a public concern that has drawn the attention of not only the public but also scholars and experts. Moreover, fog and haze have done tremendous harm to the health and even daily commuting of the general public. This memo has provided detailed information of China's fog and haze and raised three suggestions in controlling fog and haze in China by improving the current "*Law of the People's Republic of China on Prevention and Control of Atmospheric Pollution*" First, all coal-burning boilers must be installed with desulfurization facilities. Penalties from 100,000 yuan to 50,000,000 yuan will be charged upon any rejection or deception in the implementation of such process. Second, central heating with power will be carried out, and households will be subsidized 0.3 yuan for each degree of electricity. Third, the latest version of "*Law of the People's Republic of China on Energy Tax*" should be released, and a 10% energy tax will be imposed according to the energy price. The prevention and control of fog and haze must be dealt with from the source of the pollution—coal—which requires collaboration between governments, enterprises, and the public, who are all stakeholders in this process. The three suggestions will help reduce fog and haze at large.

Keywords: Chinese haze, coal burning, governance

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To: Chen Jining, Secretary of Ministry of Environmental Protection of the People's Republic of China

From: Bingshuo Liu

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Action-Forcing Event

According to a report from NASA, "many parts of eastern China were put on orange alert on December 4, 2016, when heavy smog veiled large swaths of the country. The haze stranded passengers at airports in Northern China and slowed down city life in Beijing, where the pollution index reached an orange alert level on December 1. The Visible Infrared Imaging Radiometer Suite (VIIRS) on the Suomi NPP satellite acquired this natural-color image of northeastern China on December 6. Photos taken from the ground also show low visibility—fewer than 200 meters (roughly 650 feet)—according to news reports. On December 5, People's Daily reported that smog blanketed more than 60 Chinese cities."[1] This severe smog and haze situation has been carried over to this year. As AOL News said, "Beijing residents rang in the New Year from deep inside a cloud of hazardous smog. Air pollution in Northern China was so heavy over the weekend that authorities on Sunday canceled most of flights at Beijing's main airport and suspended buses from the capital to neighboring cities, the airport said in a statement."[2]

[1] Pola Lem, "Smog and Haze in Northern China", NASA, December 7, 2016, http://earthobservatory.nasa.gov/IOTD/view.php?id=89228

[2] MARIA GALLUCCI, NEWS, "Beijing welcomed 2017 from beneath a blanket of smog", Jan 1st 2017 8:55PM. http://www.aol.com/article/news/2017/01/01/beijing-welcomed-2017-from-beneath-a-blanket-of-smog/21645473/

Statement of the Problem

According to a recent report released by the Asian Development Bank and Tsinghua University, "Toward an Environmentally Sustainable Future: Country Environmental Analysis of the People's Republic of China," seven of the ten most polluted cities in the world are in China.[3] It seems that cities with higher economic performance are more likely to be subject to fog and haze. The most severe pollution and fog are found in three areas of China: the Pan Pearl River Delta, the Pan Yangtze River Delta, and Beijing, Tianjin, and Hebei Province. Ten cities out of the 13 observed in which the number of days meeting the standard for air quality lower than 50%.[4]

Haze is generated because of extensive developmental modes and unreasonable industrial and energy structures. Its origin lies in different types of fossil energies. Coal and fuel are fundamentals ones among them. Coal is responsible for about 40 percent of the deadly fine particulate matter known as PM 2.5 in China's atmosphere.[5] Besides that, the extensive developmental ways exhaust lots of pollutants out. Data shows that Tianjin and Hebei province both have a significant amount of cement, steel, oil refining, and petrification industries that burn roughly 350 million tons of coal per year. About 24.5 percent of the PM2.5 in Beijing comes from those industries.[6] Particles of dust, sulfuric acid, nitric acid, and organic hydrocarbon make the atmosphere muddy, obscuring our sight and deteriorating visibility, with horizontal visibility less than 100 meters. The obstruction to vision caused by this aerosol system composed of non-water substances is called haze.

[3] "China has 7 among the world's 10 most air-polluted cities, Sohu, 15:22 on January 15, 2013.
[4] Lan Qingxin, Hou shan, "Research on the status quo and controlling methods of China's fog and haze.", Qinghai Social Science, First edition, 2015.
[5] EDWARD WONG, The New York Times, "Coal Burning Causes the Most Air Pollution Death in China, Study Finds", AUG.17,2016.
[6] Xinhua, China. org. cn," Experts identify causes of Beijing's air pollution", June 12, 2012.

With the prominently global environmental problems, the influence of atmospheric pollution on human health has become the main focus of both government and individual. Expect to irritating throats and eyes, pollutants in the haze would also cause serious long-term damage to health.[7] The influence of haze on people includes not only includes the acute effect, but also long-term chronic effect which can be infectious covering all ages, and become much more severe, especially for those susceptible population such as the old, the young, and the pregnant.

When haze appears, the atmospheric pollution will become increasingly serious, with bacteria and viruses in the air, causing the spread of infectious disease and various illnesses easily. According to a study on the global burden of disease, outdoor air pollution contributes to 1.2 million premature deaths in China each year, making it the fourth-leading risk factor for deaths, after dietary risks, high blood pressure, and smoking.[8] Particularly in cities, these air pollutants are difficult to proliferate, which increases the toxicity of substances like sulfur dioxide, carbon monoxide, and nitric oxide, seriously threatening people's lives, and health. When haze happens, patients with bronchial asthma will be stimulated by inhaling allergens and develop asthma symptoms, like coughing and disturbances in respiration from dust, smoke, and dust mites suspended in the fog. According to a study, continuous exposure to haze will raise the risk of cardiovascular effects, reduced lung development and the development of chronic respiratory diseases in kids.[9]

According to the latest assessment of global disease burden, 3.2 million people died resulted from air pollution in 2010, and 2.1 million of that was from Asia.[10] The

[7] BBC, NEWS, "What causes South East Asia's haze?", 26 October 2015.
[8] Hepeng Jia and Ling Wang, "Peering into China's thick haze of air pollution", CHEMICAL&ENGINEERING NEWS, Volume 95 Issue 4, January 23, 2017.
[9] Astro Awani, "Haze and health: 5 things you should know.", October 21, 2015 19:40 MYT.
[10] Lim SS, Vos T, Flaxman AD, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet. 2012; 380:2224–2260.

poisonous particulate matters in haze are an important reason of the increasingly severe cardiovascular disease. The particulate pollutants in haze give rise to common respiratory tract system disease like emphysema, asthma, bronchitis, rhinitis as well as upper and lower respiratory infection, and can be triggered acutely by haze. Moreover, these particulate pollutants might cause myocardial infarction, leading to myocardial ischemia or myocardial damage.

For the urban population of China, however, the problem of air pollution is particularly challenging, because the government exercises tight control over the economy and the media regarding not only pollution regulation but also public information regarding air quality.[11] Long-term haze has seriously affected people's life. Roundly prominent environmental pollution triggers social unrest. On the one hand, with the fast-improving national per capita income, people have increasingly high expectation on environmental quality and their health. On the other hand, China's environment has acutely deteriorated, particularly with much more serious haze around the country. In 2017, the range and degree of haze's effect have become unprecedented, and the disturbance caused by this problem has already quietly changed people's expectations about economic growth. Environmental pollution has become the unbearable burden of the Chinese economic development and government's public trustworthiness.

Meanwhile, haze has a huge influence on China's economy. Haze has conservatively caused about 23 billion RMB in direct financial losses of the national transportation and people's health, about 188 million RMB charge losses due to high-speed road closure.[12] Furthermore, what has led to 270 million RMB in direct financial losses for flight delays of civil planes, 22.6 billion RMB cost losses of emerging diseases caused by haze on

[11] Yana Jin, Mu Quan, Chiara Ravetti, Zhang Shiqiu, Timothy Swanson, "China, information and air pollution", VOX CEPR'S Policy Portal, 02 December 2015.

[12] Hepeng Jia and Ling Wang, "Peering into China's thick haze of air pollution", CHEMICAL&ENGINEERING NEWS, Volume 95 Issue 4, January 23, 2017.

January 1, 2013, according to the study of the socio-economic loss evaluation on account of haze in January 2013, which was released by the School of Environmental Science and Engineering of PKU.[13] The *2014 Annual Report of China's Inbound Tourism* says that fog and haze have already become one of the major factors hindering China's inbound tourism. According to the report, the inbound visitors recorded at around 129 million in time, which is down 2.50% on a year-on-year basis; overnight visitors for 55.6859 million, down 3.53% year-on-year.[14] With worse polluted air, one district can be often encircled in haze and thus make it less attractive to talents, which is of great importance to the local economic growth. Besides, some enterprises necessarily take environmental factors into account when they want to reside in a place because corporation managers and staff will not be willing to work and live in a place with a heavily polluted environment. Therefore, haze weakens one region's competitiveness, causing brain-drain, which is a serious result of air pollution. According to Patrick Chovanec, chief strategist at New York-based Silvercrest Asset Management, China's pollution problem has already had an adverse impact on the economy, which has slowed to a growth rate of around 7.5 percent, very different from days of 9-10 percent expansion.[15]

[13] Hepeng Jia and Ling Wang, "Peering into China's thick haze of air pollution", CHEMICAL&ENGINEERING NEWS, Volume 95 Issue 4, January 23, 2017.

[14] "Fog and haze to become one of the major factors hindering China's inbound tourism", Xinhua Daily, 10-20-2014. http://news.xinhuanet.com/local/2014-10/20/c_1112901222.htm

[15] Katie Holiday, "China's Smog- What Are the Economic Costs?", CNBC, Thursday, 11 Jul 2013 | 1:39AM ET.

History

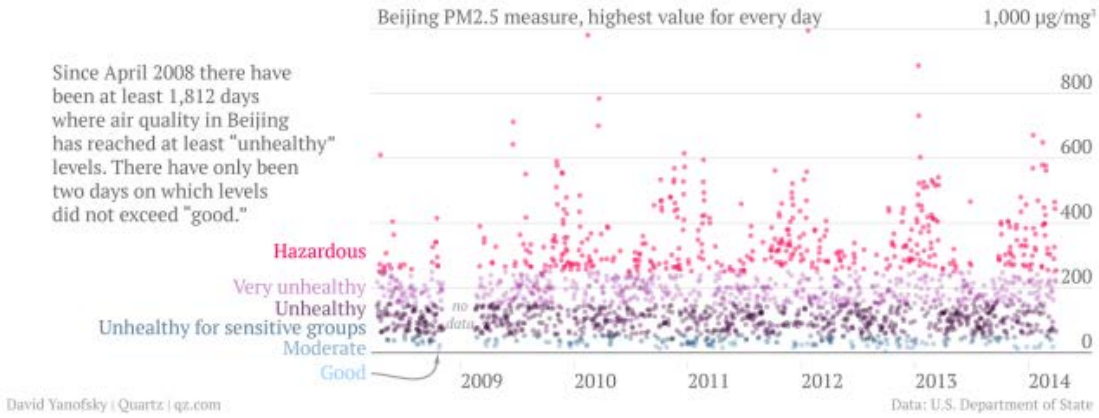
According to China's environmental protection ministry who has published a report in November 2010, about a third of the 113 cities surveyed failed to meet national air standards.[16] Chinese haze pollution is not a recent phenomenon but with a long story. The earliest records of Beijing's haze dates back to the Yuan Dynasty (1271-1368) where, according to *The History of Yuan Dynasty* by Yuan scholars Song Lian and Wang Yi, a heavy haze plagued the city in March under the lunar calendar of 1329. The main cause was insufficient rains and an absence of snow.[17]

On January 1, 2013, the government of Beijing formally set air quality monitoring data, by which it can evaluate its air quality through measuring PM2.5 concentration per cubic meter. The survey data about January from the Chinese Ministry of Environmental Protection shows that the average monthly haze days of Jiangsu, Beijing, Zhejiang, Anhui, and Shandong were 23.9, 14.5, 13.8, 10.4, and 7.8, respectively, which are all their maximum haze days compared to those at the same time since 1961. In Central and Eastern China, more than 25 days in most stations are with PM2.5 concentration over-standard, and some regions' PM2.5 concentrations have reached maximums in the past five years.[18] On November 4, 2013, it was pointed out in the *Green Book of Climate Change: Annual Report on Actions to Address Climate Change* (2013), which was released by the Chinese Academy of Social Sciences and the China Meteorological Administration, that in the recent 50 years, haze in China has shown an increasing trend overall. In particular, days with haze have markedly increased, with significantly

[16] Jeffrey Hays, "AIR POLLUTION IN CHINA", FACTS AND DETAILS, January 2014.
[17] Ervin Zhong, "A history of Beijing's Hazy Shade of Winter", ChinaMATTERS, December 11, 2015.
[18] "the nation suffer the most serious haze weather in history in 2013, hitting a 52-year record", China.com, December 30, 2013. http://news.china.com/news100/11038989/20131230/18251698.html

increased durative haze.[19] On December 7, 2015, Beijing firstly issued a red warning signal of haze. That was followed by 24 cities issuing red alerts for air pollution. Red is the most serious level in the country's warning system.[20] On December 18, 2015, Beijing issued a red alert of air heavy pollution once again. Beijing authorities have advised residents to reduce outdoor activity and for schools to stop classes.[21]

In just 30 years, China has developed from a poor agricultural country to a global manufacturing powerhouse. Its model of investing and producing at home and exporting to developed markets has elevated it to the world's second-largest economy after the USA. However, just as the speed and scale of China's rise as an economic power have no clear parallel in history, its pollution problem has shattered all precedents. Environmental degradation is now so severe, with such stark domestic and international repercussions, that pollution poses not only a major long-term burden on the Chinese public but also an acute political challenge to the ruling Communist Party.[22]



[19] "Green Book of Climate Change points the reasons of haze and its harm, Southern Weekly, November 5, 2013.
[20] Jay Croft, "China issues first-ever red alert for fog", CNN, Updated 4:48AM ET, Wed January 4, 2017.
[21] "China smog：Beijing issues second ever pollution red alert", BBC NEWS,18 December 2015.
[22] Joseph Kahn and Jim Yardley, "As China Roars, Pollution Reaches Deadly Extremes", The New York Times, AUG 26, 2007.

Graph 1[23]

The World Health Organization recommends a maximum daily exposure of 25 micrograms per cubic meter of PM2.5 (air pollution particles smaller than 2.5 micrometers in diameter that are dangerous to human health). Beijing's annual average in 2014 exceeded 100 micrograms per cubic meter, according to data from the US embassy.[24] From the chart, it is easy to find that the horizontal axis of the chart represents the time from 2009 to 2014 while the vertical axis of the chart represents the air pollution degree from "Good" to "Hazardous." We can see that most of the time, Beijing has an unhealthy level of air pollution.

It is believed that extensive coal combustion method is the main reason of haze. According to a study the researchers released in Beijing, coal is responsible for about 40 percent of the harmful fine particulate matter known as PM 2.5 in China's atmosphere.[25] In China, 90% of sulfur dioxide, 60% of draining quantity of smoke and dust, as well as 67% of nitric oxide in the air comes from coal emissions. These three substances are significant contributors to haze.[26] Meanwhile, China is the world's largest consumer of coal, which is its main energy source. It is responsible for around half the world's coal consumption. Coal wastage in China has been staying high, one reason of which is its unreasonable industrial structure, with heavy industry as the vast majority.

According to a study by the University of International Business and Economics, the proportion of the output value of the Chinese light industry decreased from 41.9% to 30% while that of the Chinese heavy industry increased from 58.1% to 70% from 1999 to 2011.

[23] Lily Kuo, "Six years of Beijing air pollution summed up in one scary chart", QUARTZ, April 10, 2014.
[24] "Why is the Pollution So Bad in Beijing?", PRICEONOMICS, Jan 4, 2016.
[25] EDWARD WONG," Coal Burning Causes the Most Air Pollution Deaths in China, Study Finds", The New York Times, AUG.17, 2016.
[26] Kaiqi Chen, Hongmei Yang, "The equilibrium mechanism between economic development and haze governance", Social Sciences Research, June, 2015.

At the same time, China's national discharge of industrial waste gas increased from 1,268 million tons in 1999 to 5,191 million tons in 2010, with a yearly growth rate of 13.7%.[27]

Waste gas is mainly discharged through coal-fired boilers, which are divided into industrial boilers and civil boilers. The former kind is majorly applied to heavy industry while the latter type is chiefly applied to water heating and small-scale residence districts' heat supplies in winter. According to the statistic profile of quality and technology supervision released by the General Administration of Quality Supervision, Inspection, and Quarantine, the numbers of Chinese industrial boilers in use at the end of 2009, 2010, and 2011 are separately 595.2 thousand, 607.3 thousand, and 620.3 thousand. It is analyzed by the Ministry of Environmental Protection that industrial coal-fired boilers are not universally used along with air pollution control facilities in China, usually only with simple devices removing PM.[28] Meanwhile, a coal-burning industrial boiler more often than not uses raw coal not selected by washing whose high level of ash and sulfur as well as low granularity result in combustion inefficiency and high pollutant emission which accounts for 45% to 65% of urban air pollution.[29]

Civil boilers are majorly employed in villages and urban-rural fringe areas in the north of China. They are distributed dispersedly on a small scale, so it is difficult for the government to supervise. In China, central heating in rural areas is an arduous task on account of their uneven development and without the unitary heating system, totally banning the use of fire-coaled boilers in rural areas is tough for the government. The coal purchase is mostly the right of farmers so that they would intend to buy cheaper coal, which is much easier to cause pollution after being burned without cleaning measures like

[27] Weixian Wei, Xili Ma, "The best policy options of energy structural adjustments and haze governance", CHINA POPULATION, RESOURCES AND ENVIRONMENT, Vol.25 No.7 2015.

[28] "The survey shows that coal-fired boilers are the main reason of haze", Sina, February 6, 2013. http://news.sina.com.cn/c/2013- 02-06/015226214853.shtml

[29] "China Boiler Industry Research Report 2015-2019", April 2016.

dust extraction and sulfur removal. Based on the main waste gas pollutant discharge around the world in 2012, as shown in the 2012 Chinese Environmental Condition Report, the total emissions of carbon dioxide reached 21.176 million tons, with the industrial emissions accounting for 19.117 million tons while the life emissions accounted for 2.056 million tons. The total emissions of nitric dioxide reached 23.378 million tons, with the industrial emissions 16.581 million tons while the life emissions 0.393 million tons.[30] We can see that coal-fired boilers are the main emission source of sulfur dioxide and nitric oxide in China.

Another primary reason which causes haze is the exhaust gas emission of urban vehicles. The waste gasses discharged from vehicles mainly include CO, CHx, NOx, and PM 2.5. According to 2014 China Vehicle Emission Control Annual Report released by the Ministry of Environmental Protection, the total emissions of Chinese vehicle pollutants in 2013 reached 45,709 thousand tons. With China's urbanization process being pushing forward, increasingly people rush into the major cities, like Beijing, Shanghai, and Guangzhou. In the meantime, as people's living standard improves, their demand for vehicles increase day-by-day. In 2014, 16.5 million vehicles were sold in America while more than 23 million vehicles were sold in China.[31] At the end of 2014, the vehicle ownership in China reached 264 million, with the average annual growth amount of more than 15 million in the past five years.[32] It is worth noting that large diesel trucks—such as those used on most long-distance trucking routes—comprise only about 5 percent of China's total vehicle fleet but emit an estimated 60 percent of total particulate

[30] Nian Zhongguo, Zhuang Kuang, Gong Bao, "2012 Chinese Environmental Condition Report: Air Environment," *MEP*, June 6, 2013; http://jcs.mep.gov.cn/hjzl/zkgb/2012zkgb/201306/t20130606_253402.htm.
[31] "China's car sales growth halves in 2014", BBC NEWS,12 January 2015.
[32] Pan Huang, "Problems and improvements of motor vehicle exhaust pollution control system", March, 2016.

matter from vehicles.[33]The reasons are, on the one hand, PM discharged from diesel vehicles is more than that from private cars. According to the 2016 China Vehicle Environmental Management Annual Report, diesel vehicles only accounted for 12.6% in 2015, of which the nitric oxide emissions (3,720 thousand tons) and PM 2.5 emissions (53.6 thousand tons). However, they separately accounted for more than 69% and more than 99% of the total discharge emissions of vehicles.[34] On the other hand, Chinese petroleum production is monopolized by the big state-owned enterprises, CNPC and Sinopec, whose petroleum products are low in quality. Wang Yukai, a professor at the National School of Administration, said, "I believe the new Chinese administration is supposed to weaken CNPC and Sinopec for the two interest groups wield too much power."[35]

In an attempt to address the growing haze problem, the Chinese government has introduced many measures.

In September 2013, the State Council released *Air Pollution Prevention and Control Action Plan* which is called the strictest air pollution administration policy by various industries. Chinese government revised and passed Atmospheric Pollution Prevention and Control Law of the People's Republic of China (EPL) on August 29, 2015, which was put into force on January 1, 2016. The revised EPL proposed that China would gradually reduce coal's proportion in energy consumption. Meanwhile, the law required that the local governments strengthen their management of civil coal fires and that the country bans the importation, sale, and combustion of coal below the quality standard. Simultaneously, the new EPL ruled that the nation must introduce total emission controls and set goals for emission control. Regarding coal-fired boilers, the new EPL ruled that

[33] Christina Larson, "China's Autos Need to Emit Less Pollution", Bloomberg, 2-4-2013. https://www.bloomberg.com/news/articles/2013-02-04/china-s-autos-need-to-emit-less-pollution
[34] Bote Luo, "diesel exhaust gas, the neglected culprit of haze", Finance.china.com.cn, 2-8-2017. http://finance.china.com.cn/roll/20170208/4090129.shtml.
[35] REUTERS, "Politics of Pollution: China's Oil Giants Take a Choke-Hold on Power", CNBC, 3 Feb 2013.

the nation is forbidden to build facilities burning highly-polluted fuels and that the local governments dismantle coal-fired boilers which could not guarantee emissions standard.

A new vehicle law stipulated that the Chinese government should take various measures, like financing, revenue, and government procurement, to generalize the application of energy-savings, environment-friendliness, and new energy motor vehicles as well as motor vessels, to limit the development of motor vehicles and motor vessels with high oil consumption and high emissions and reduce fossil fuel consumption. The law also stipulates that the Chinese government should ban the production, import, and sales of vehicles whose air pollutant emissions are not standardized and recall heavy-duty diesel vehicles with nonstandard pollutant discharge levels. Some big cities, such as Beijing, Tianjin, and Shanghai, have imposed policies to limit the number of cars on the road on any given day and banned coal burning in urban areas since 2012.[36] Especially on December 2, 2015, Chinese Prime Minister Li Keqiang hosted an executive meeting of the State Council, to push for further research and air pollution. China's Ministry of Environmental Protection once tried to announce some strong diesel fuel standards in allusion to trucks and buses in 2011. However, the two actions failed for CNPC and Sinopec's opposition.[37]

[36] Hepeng Jia and Ling Wang, "Peering into China's thick haze of air pollution", C&EN, Volume 95 Issue 4 | pp.19-22, January 23, 2017.

[37] Barbara Finamore, "China Proposes New Fuel Standards in Response to Severe Air Pollution", NRDC, February 08, 2013. https://www.nrdc.org/experts/barbara-finamore/china-proposes-new-fuel-standards-response-severe-air-pollution

Background

The following groups are in a pivotal position to solve haze pollution in China.

The first is the Central Government of China and its leadership. The Central Government of China is the actual master of China. Therefore it needs to take the primary responsibility for solving haze. Due to the power exerted by China's one-party dictatorship, published laws and decrees, in general, can be effectively carried out by the Chinese government with great determination. For instance, in 2015, Beijing's air quality reached the optimal level during China's military parade at a high economic cost beneath clear weather. The Chinese military parade in 2015 began from September 3, and since August 20, Beijing had already started to formally implement some measures with which to guarantee good air quality, like the odd-and-even license plate rule, production halts, production limitations for industrial enterprises, building demolition, as well as construction site lockouts. The Chinese government ordered over 12,000 factories to suspend operations.[38] Not only that, but the Chinese government carried out strict supervision and punishment of enterprises and factories located in provinces and cities near Beijing. According to a report, to ensure the air quality during the Chinese military parade, the government closed 12,255 coal-fired boilers and factories. Moreover, the Chinese government limited 5 million vehicles to drive on every other day.[39] As for traffic controls, the Chinese government even limited the use of 80% government vehicles.[40] Thus, it can be seen that, with great resolve, the Chinese government can make

[38] MARK HANRAHAN, "China Military Parade: Restrictions on Industry, Infrastructure Are Cost Of Symbolically Important Event For Government", International Business Times, 08/28/15 AT 5:34 AM.
[39] Jonathan Kaiman, "After 'military parade blue'skies, pollution returns to Beijing", Los Angeles Times, FEB.19, 2017.
[40] "what has Beijing done for blue weather during the parade, Bendibao.com, 08-28-2015. http://bj.bendibao.com/news/2015828/199956.shtm

it out in front of specific events, so the treatment of haze with great determination is also necessary for the government.

The second group is China's heavy industrial corporations and its largest petroleum manufacturing enterprises—CNPC and Sinopec. In the past 30 years, China has developed its economy through its industrialization with an extensively managed heavy industry sector. However, Chinese heavy industrial enterprises mostly use coal-fired boilers and neglect environmental pollution. As a key part of discharging pollutants, these heavy industrial firms must achieve technological innovation and implement limit their coal use. The coal-fired boilers of CNPC and Sinopec are not mostly equipped with desulphurization devices. Bases on a report by the Chinese Ministry of Environmental Protection, the CNPC possesses 115 coal-fired boilers. A total of 38 of them are not equipped with desulphurization devices, and none of them are equipped with denitration devices. Sinopec has 174 boilers. A total of 40% of them not equipped with desulphurization devices, and only four are equipped with denitration devices.[41]As the largest petroleum manufacturing companies, they have absolute control over Chinese petroleum quality. Yue Xin, head of the Vehicle Fuel Emissions Laboratory at CRAES, said, "the two corporations take the outright lead in setting oil product standards." It is necessary to know whether the two companies can supply petroleum according to new standards. Their words like "we can't supply petroleum under the new standards' can always overturn the previously-drafted standards."[42] The problem of Chinese oil upgrade is always a focus, but it is a cost that has been the crux rather than technology. Experts explain that a fuel upgrade adds 300 yuan per tonne to sulfur-removal expenses, which

[41] Liu Minghe, Yuan Duanduan, "China's oil giants punished for environmental failings", chinadialogu, 23.09.2013. https://www.chinadialogue.net/article/show/single/en/6367-China-s-oil-giants-punished-for-environmental-failings.

[42] Liu Minghe, Yuan Duanduan, "China's oil giants punished for environmental failings", chinadialogu, 23.09.2013. https://www.chinadialogue.net/article/show/single/en/6367-China-s-oil-giants-punished-for-environmental-failings.

does not include the previous cost of equipment upgrade. The problem that who bears the costs is related to the various benefits of producers, consumers, and even the national tax revenue. It is conservatively estimated that the cost of China's oil upgrade is more than 50 billion RMB.[43]As the largest interest groups, the two corporations are not willing to bear the high costs naturally.

The third one is Chinese media. In relating to haze in China, the best-known media professional is a former journalist from CCTV called Chaijing. On February 28, 2015, she made a lecture called "Under the Dome," which attracted people's considerable attention nationwide. To film this documentary at her own expense, Chaijing had called on many governmental officials and environmental experts. Moreover, she traveled to numerous developed countries and sought their management experience. In this documentary, Mrs. Chai condemns industrial benefits and plenty barriers set up by large-scale energy enterprises as well as bureaucracies for their obstructions of highly effective environmental governance. In a few short days, this documentary has been watched over 35 million times on various websites in China.[44] However, this film suffered the ban of the Chinese government. On March 2, China's media authorities sent out a directive to media demanding no reports related to the documentary "Under the Dome." Accordingly, the official media, such as the Peoples Network and Xinhua Online, began to remove their videos and deleted nearly all articles connected to it. On March 3, 2015, the National People's Congress of the People's Republic of China and the Chinese People's Political Consultative Conference were inaugurated. Doubtlessly, China's media is state-controlled. According to research, the media in China is nearly owned by the Chinese government.[45]

[43] Liu Linpeng, "Chinese car and oil industries argue over air pollution costs", chinadialogue, 27.03.2013. https://www.chinadialogue.net/article/show/single/en/5827-Chinese-car-and-oil-industries-argue-over-air-pollution-costs.

[44] CHRIS BUCKLEY, "Documentary on Air Pollution Grips China", The New York Times, March 2, 2015.

[45] Shleifer, A, S Djankov, C McLeish and T Nenova (2003) "Who owns the media?" *Journal of Law and Economics*, 46(2): 341–81.

Despite the significant number of reports about haze released by the Chinese media, most of them are to satisfy the needs of government. Jeremy Goldkorn, a commercial consultant who follows Chinese media in Beijing, said, "News media, from People's Daily to CCTV, are all thoroughly covering this story rather than being actively trying to solve it." According to a study by Peking University, the Chinese government takes advantage of media to attract people's attention on the damage of haze rather than warning them of pollution peaks, and furthermore, the government attempts to reduce people's sensitivity to haze.[46]

The fourth major political actor is the Ministry of Environmental Protection of the People's Republic of China, which is a member of the Chinese State Council. It undertakes the following responsibilities: Draft and implement environmental protection programs, policies, and standards; supervise and manage environmental pollution prevention; formulate and carry out environment policies; oversee and execute laws; and coordinate environmental affairs in cross-administrative regions. The Chinese Ministry of Environmental Protection is the direct organization that oversees and manages haze, so it is supposed to take responsibility for formulating air pollutant discharge standards, executing environmental protection laws and rules established by the government, and strictly supervising enterprises' air pollutant emissions.

[46] Yana Jin, Mu Quan, Chiara Ravetti, Zhang Shiqiu, Timothy Swanson, "China, information and air pollution", VOX CEPR'S Policy Portal, 02 December 2015.

Policy Proposal

Haze in China is still serious even though the government has published some laws and measures to solve it. For the long-term haze management, the government should take various actions such as legislation, tax, stimulation, and punishment to manage haze in every aspect comprehensively.

Policy Authorization

The proposal is to modify the current *Law of the People's Republic of China on Prevention and Control of Atmospheric Pollution.* In August 2015, the latest version of *Law of the People's Republic of China on Prevention and Control of Atmospheric Pollution*—the strictest law for the protection of environment ever—was issued. The new law, however, is not a flawless one. It has no mandatory requirement to upgrade the existing coal-fired boilers in certain enterprises, and there are no clear fines set for pollution. Instead of taking a compulsory measure to update the old boilers, the new law only urges relevant authorities of the State Council and local governments to promote the production and use of clear energy.[47] Despite "the ceiling of a 500,000 Yuan" fined for air pollution accidents conducted by engaged enterprises or institutions was canceled in the strictest law, there is still not yet any specified definition upon how much fine should be charged.[48] Therefore, a new discussion is needed on the part of the National Congress if the smog and haze are to be effectively eradicated.

China's current tax laws consist of *Personal income tax law of PRC*, *Vehicle and vessel tax law of PRC*, and *PRC Law on the Administration of Tax Collection*. Not yet has there been a law specified to energy tax in China, neither has the government levied energy tax on fossil fuels such as coals. Therefore, it is advisable that the government

[47] Law of the People's Republic of China on Prevention and Control of Atmospheric Pollution
[48] Liu Qin, "China's new Air Pollution Law omits key measures in war on smog", china dialogue, 04.09.2015.

should implement a law, namely, the *Law of the People's Republic of China on Energy Tax*.

Policy Implementation

Followed are measures suggested to revise the current law on the prevention and control of air pollution and in enacting a new tax law on the protection of the atmosphere, as well as specific responsibilities of the governments in this process:

1. All coal-fired power plants, coal-fired boilers, and coal chemical industrial devices are compulsively required to be equipped with desulfuration devices. The Ministry of Environmental Protection supervises the enterprises in installing pollution prevention equipment. For those who refuse to install the equipment or those who shall conduct a deception in this process, fines can be higher than 100,000 yuan, up to 5,000,000 yuan will be charged by the Ministry of Environmental Protection. The Ministry of Finance is responsible for collecting the money.

2. The government should ensure there is central heating in rural areas in North China. According to *2015 China Statistical Yearbook* released by National Bureau of Statistics, a total sum of 2,873,342 rural households in North China, and the disposable income of rural residents in North China is 9,492 yuan per year.[49] The government needs to replace the old coal-fired boilers with electric heating facilities to realize central heating for each rural household. Each electric heating facility costs 300 yuan. The Heating Management Office in various regions should install electric heating facilities for rural people for free. The Ministry of Finance should bear all the expenses in purchasing those facilities and subsidize for each rural household 0.3 Yuan for the consumption of 1kw/h's electricity.

[49] 2016 China statistical yearbook

3. Levying energy tax on coal is a major link to the establishment of a new energy tax law. The State Council should set out the tax rate on coals and charge at 10% price of the energy. The local governments shall submit the taxes levied from local enterprises to the Ministry of Finance.

Policy Analysis

Pros:

Massive amounts of energy consumption and the energy consumption structure are the principle reason for China's long-term air pollution conditions. At the end of 2009, 2010, and 2011, the numbers of China's coal-fired boiler in use were separately 595,200, 607,300 and 620,300.[50] It is analyzed by the National Ministry of Environmental Protection, the use of atmospheric pollution controlling facilities in Chinese industrial coal-fired boilers is not general, usually only with simple devices of eliminating PM. Based on statistics, in 2015, China's industrial coal-fired boilers in use were bout more than 470 thousand, accounting for more than 80% of industrial boilers; China annually consumed 400 million standard coals, accounting for about one-quarter of the national total coal consumption.[51] Thus, it is clear that the upgrade of industrial coal-fired boilers and strict installation of air pollution prevention equipment can reduce pollutants' emissions. According to the initial calculation, China can annually reduce about 500 million tons of carbon dioxide, about 3 million tons of sulfur dioxide, about 300 thousand tons of dust and about 30 million tons of waste residues if all of existing industrial coal-fired boilers are transformed and upgraded, substantially perfecting its air quality.[52] So, it is necessary for the Chinese government has to upgrade industrial coal-fired boilers. The government shall fine corporations that refuse to install air pollution prevention equipment. At present, China's environmental protection laws should be refined by adding definite fines.

[50] "Coal-fired boiler is the main reason", First Economic Daily, 02-06-2013. http://news.sina.com.cn/c/2013-02-06/015226214853.shtml

[51] "China has 0.47 million coal-fired boilers", people.cn, 12-08-2015, http://politics.people.com.cn/n/2015/1208/c70731-27902473.html

[52] "China has 0.47 million coal-fired boilers", people.cn, 12-08-2015, http://politics.people.com.cn/n/2015/1208/c70731-27902473.html

Another proposal in the memo is to substitute coal-fired boilers with electric heaters in rural areas, which can be prompted by the following measures: to provide full subsidies with farmers for their purchase of electric radiators by the National Bureau of Finance, to offer farmers 0.3 RMB every time they use 1 KW electricity per hour, and to install electric heaters by the local heating office in unified way. These methods can significantly reduce haze pollution in China's northern rural areas. According to research, if electricity were substituted for coal-fired central heating in 2010, then the PM 2.5 emissions would be reduced by 73,424 hundred tons, with the SO2 emissions lowered by 4,021 hundred tons and the nitric oxide emissions decreased by 2,256 hundred tons throughout the country.[53]

On the one hand, electric remains as the cleanest and most convenient form energy, which always delivers high efficiency. According to a study, annual coal reduction will reach 450 thousand tons if electric heaters replace all coal-fired boilers.[54] Thus, it is clear that the replacement of electricity for coal will enormously reduce pollutant discharge, which is advantageous for environmental protection.

Also, it is much cheaper to warm them by electricity than by coal for farmers. Usually, Chinese farmers need to purchase 4 to 5 tons of coal each winter, at a cost of 3,000 RMB.[55] Currently, China's electricity charge is 0.5 RMB per 1kw/h while farmers averagely need 8,000kw of electricity to spend during the winter.[56] Consequently, their costs of spending the winter are about 1,600 RMB if the Ministry of Finance offers 0.3 RMB per 1kw/h's electricity to farmers, which is nearly half of their coal-fired heating

[53] Pang Jun, Wu Jian, Ma Zhong, Liang Long-Ni, Zhang Ting-Ting, "The emission reduction consequences of China's cities' atmospheric pollution by replacing coal-fired central heating with natural gas" *China Environmental Science*, 2015, 35(1): 55-61.

[54] "Beijing's farmers' hibernation in Tongzhou District", the Xinhua New Agency, November 8 2016. http://www.farmer.com.cn/xwpd/dfny/201611/t20161108_1252385.htm

[55] "Beijing's replacement of coal by electricity in heating supply", *Beijing Daily*, March 3, 2016. http://coal.in-en.com/html/coal- 2334357.shtml

[56] "Beijing's replacement of coal by electricity in heating supply", *Beijing Daily*, March 3 2016. http://coal.in-en.com/html/coal- 2334357.shtml

costs. At the same time, electricity is easier to use than coal-fired boilers for farmers as they do not have to worry about relevant safety problems like carbon monoxide poisoning.

The third proposal is to enact a PRC law on energy tax, particularly levy energy tax on coal. Taxation policy of haze prevention and treatment directly acts on business and individual costs-income relation, and further leads and adjusts their economic behaviors to reduce atmospheric pollution and effectively manage haze. Therefore, this policy currently becomes the most extensively applied policy tool of haze prevention and control in all over the world. Although the reasons for haze formation are complicated, the main ones are its various sources such as waste gas discharged from coal firing, motor vehicle' off-gas, dust due to capital construction as well as inhalable particles caused by nitric acid particles and vitriolic acid particles generated from sources of pollution like factories.

In 2010, the India Government levied a clean energy tax for the use of research studies of clean energy technologies. The tax revenue is 50 rupees (about 1 dollar) per ton. It is estimated that India annually produced 610 million tons of coal in 2010 and 2011, with 30 billion new tax revenues annually.[57]

The reason why coal is China's main energy is its lower price compared to other energy. Take natural gas as an example. In China, natural gas is about three times as expensive as coal, and the market price of coal is 3-4.5 Yuan per cubic meter. This is equivalent to 0.3-0.45 yuan's worth of natural gas per 1kw/h while the market price of one tonne of coal with 5,000 kilocalories is about 450 yuan, which amounts to 0.1 yuan coal per 1kw/h.[58] Thus, the way of levying coal energy tax on corporations is advantageous for China's energy structure.

[57] Dinesh C.Sharma: Clean Energy Tax for India, Frontiers in Ecology and the Environment,April,2010.

[58] " An analysis of three bottlenecks among Chinese replacement process of coal by natural gas", ASKCI, 04.01.2014, http://www.askci.com/news/201404/11/1114422037915.shtml

Cons:

Although electric heating is cleaner, the transition to electric heating from coal heating would put huge pressure on the government. According to current research, installing a power grid in Northern China alone would cost 33.85 billion yuan.[59] Take Beijing for example. To accomplish the transition covering 674,000 households, 1,521 villages in total, is to install grid covering a land area of 650.92 kilometers.[60]

Meanwhile, it would take a long time to make electric power heating universal in rural areas. On the one hand, installing electric heating facilities and offering subsidies for electrical energy would be a tremendous cost for the government. According to National Bureau of Statistics, the rural population in 2015 was roughly 600 million, and around 200 million rural households were assuming that each family has three people.[61] Each electric facility costs 300 yuan, the government would then have to spend about 60 billion yuan to cover all rural households nationwide. Each kilowatt of electricity costs 0.5 yuan, and each household needs 8,000kw of electricity over a winter. Each kilowatt of electricity generates 0.3 yuan of subsidies for a household. It would cost a totally 480 billion yuan for the government each year. If adding the cost of installing those facilities, the total expense would amount to about 540 billion, which is a huge sum. On the other hand, there are still some odds that some rural households would reject adopting electric heating. Rural residents in certain extremely poverty-stricken areas might just sell their electric heating facilities in exchange for highly polluting coal or just continue to burn the wood for heating as they used to.

[59] Ma Ding, "Opportunities and challenges in the strategy of replacing coal heating with electric heating", ENVIRONMENT AND SUSTAINABLE DEVELOPMENT, NO.5 2016.

[60] "Construction of power grid in the transition to electric heating in Beijing", CNR.CN, 3-1-2017. http://news.cnr.cn/native/city/20170301/t20170301_523628948.shtml

[61] "Statistical Bulletin on National Economic and Social Development", National Bureau of Statistics of the People's Republic of China, 02-29-2016. http://www.stats.gov.cn/tjsj/zxfb/20160229_1323991.html

The coal market represents a major proportion of the total energy consumption in China and plays a significant role in the macroeconomy. According to the China Coal Industry Association, coal production yielded 3.7 billion tons in 2013. In the same year, the coal consumption was 3.61 billion tons, representing 70% of total energy consumption.[62] Levying energy tax on coal sales might help in changing energy structure. However, some adverse effects might be incurred as well. One implication would be manifested in economic growth. On the one hand, the lifted tax would render coal enterprises under exacerbated pressure in its operation, with its profit significantly reduced. On the other hand, imposing a tax would raise the price of coal products, which inevitably translates into higher cost for downstream enterprises and of course, narrows their profit. Another implication of the tax will be seen in an elevated unemployment rate. Because levying a tax on coal would, in some way, reduce the size of the economy, the labor market is likely to suffer accordingly and have few jobs available. With AVE (ad valorem rate of tariff) of the coal resource tax being 4%, 6%, 8% and 10% respectively, employment rate falls respectively by 0.0025%, 0.0793%, 0.107%, and 0.159%.[63]

Upgrading industrial coal-fired boiler is also costly and would require a considerable amount of time to accomplish. As estimated, there is a total of 250 million kilowatts of coal-fired boilers. If all were replaced with electric boilers, each kilowatt would cost an extra 0.2 yuan in its cost, or another 200 billion yuan in generating power. [64] 10,000 yuan is required to upgrade coal-fired boilers by installing desulfurization equipment instead of replacing them with electric boilers. There is a total of 470,000 coal-fired boilers in

[62] Yang Zaimei, "the economic implication and suggestions on policies of reform in coal resource tax", 9-1-2014. http://www.xzbu.com/2/view-6135369.htm

[63] Yang Zaimei, "the economic implication and suggestions on policies of reform in coal resource tax", 9-1-2014. http://www.xzbu.com/2/view-6135369.htm

[64] Tao Guangyuan, "A universal reform for transformation from coal to gas heating doesn't have a ground in China", Caijing.com, 8-11-2016.

China.[65] Altogether it would cost 4.7 billion yuan for such equipment, which is both expensive and inefficient. Punishment for enterprises in violation of regulations or laws is needed, but some enterprises would bribe the governments to avoid supervisions and penalty.

By enacting new legislation on energy tax, the use of coals could be effectively harnessed, or even reduced, because it would be much more expensive for enterprises than before to product with coals because of the tax. This is an ideal scenario, in which the living and production environment would be much improved because of the reduced pollution. However, enacting a new law would take an extended period of preparation, and the way it would be processed is meant to be complicated, such as drafting specific items and regulations, designing comprehensive policies and measures in ways of levying the tax, and submitting for the approval of the State Council. This would undoubtedly be a long-term effort.

[65] "Coal consumption of China's coal-fired industrial boilers is about 400 million tons of coal", Economic Daily, 02-12-2015. http://www.ce.cn/xwzx/gnsz/gdxw/201512/02/t20151202_7252772.shtml

Political Analysis

The State Council of China is an important political player of haze. Moreover, Li Keqiang, China's deputy prime minister, expressed his determination of haze control." Li Keqiang said that "Haze has now become the most popular word on the internet, showing its priority of improving people's livelihood. The government cannot absolutely avoid this problem." [66] As the directly responsible part, the Ministry of Environmental Protection has taken much pressure from the outside and the public for severe haze problem despite its relevant measures. Chen Jining, the head of the ministry showed that the ministry would be determined to take various actions to solve haze in China's 2016 environmental protection working conference.[67]

Another political player is Chinese people. For instance, in 2013, the permanent resident population in the Beijing/Tianjing/Hebei region was 109.2 million, accounting for 8% of the total population, and the GDP of the area was 6,217,100 million RMB, accounting for 10.9% of the GDP of the country. Its economic development level is superior to that of the nation.[68] The public awareness of environmental protection has generally increased, despite the intensified atmospheric pollution in this area for the past few years. According to a survey by Tsinghua University, Beijing residents overall keep a watchful eye on various environmental protection problems, among which air quality ranks first (90.2%).[69] The awareness rate reached 85.5%, and 41.3% interviewed believe PM2.5 is harmful to human health.[70] Citizens also pay much attention to air quality on

[66] "The Chinese government declares war on haze", People's Daily, 4-29-2015, http://politics.people.com.cn/n/2015/0429/c1001-26927099.html

[67] "The report of Chen Jining, the head of the Ministry of Environmental Protection in China's 2016 environmental protection working conference", 1-8-2016.

[68] China Energy Statistical Yearbook 2013.

[69] Tan Boping, "The idea reflection and institutional reconstruction of cities' haze control", Chinese Society of Environment and Resources Law, 7-17-2015.

[70] Tan Boping, "The idea reflection and institutional reconstruction of cities' haze control", Chinese Society of Environment and Resources Law, 7-17-2015.

account of frequently-occurring haze. In 2013, the number of Beijing petition letters related to atmospheric pollution was 18,958. According to statistical data about Beijing's 12,369 environmental complaint, report, and reference center, the proportion of those connected with atmospheric pollution in the total accepted petition letters were 64.6%, 55.6%, and 58% in 2013, 2012, and 2011, respectively.[71] Thus it can be seen that, with more than a half of environmental complaints related to air contamination, citizens are discontented with air pollution conditions at present. Therefore, the government must attach importance to the adverse influence of haze pressured by the improved economic level and strengthened public environmental awareness.

Chinese governments, electric power plants, and farmers are stakeholders of electric central heating. It is estimated that there are annually more than 300 million tons of decentralized civil coal in China, accounting for no more than 10% of the total coal consumptions.[72] However, the atmospheric pollutants discharged from firing 1 ton of decentralized coal are ten times more than that of electricity-coal due to the lack of dust and sulfur-removal devices. Along with the fast-developing urbanization and industrialization, small industrial boilers and civil coal consumption near cities are constantly increasing, especially those involved in the cooking and heating of farmers, which generate a significant number of pollutants, like organic volatile impurities and dust.

For Chinese governments, controlling haze is its duty. The central heating for farmers can effectively reduce the use of individual coal-fired boilers and simultaneously help governments prompt a sound image and reputation. Thus, people trust the

[71] Tan Boping, "The idea reflection and institutional reconstruction of cities' haze control", Chinese Society of Environment and Resources Law, 7-17-2015.

[72] "High costs limit the advance of the individual electric-heating mode", Sina' real estate, 3/31/2017, http://news.dichan.sina.com.cn/2017/03/31/1228591.html

authorities' practical measures to manage haze and government will obtain more public confidence and support from people in return.

For electric power plants, they can get more markets and profits by electric central heating. The electric heating technology is just a start-up in China. The penetration of electric heating technologies is high in developed countries in Europe and North America, with rates of 90% in Norway, 80% in Japan and South Korea, 70% in France and Sweden, and more than 50% in America and other European countries.[73] Consequently, such a broad market will bring considerable profits to electric power plants.

For farmers, it is more convenient for them to use electric heating mode than to use traditional coal-fired heating mode because they do not need to buy coal outside in winter and to deal with residues from coal burning. At the same time, 0.3 RMB allowance from governments on farmers' use of 1 kWh of power will highly reduce their heating costs in winter for electric heating. According to the estimation, China's average electricity price in heating will be 0.142 RMB per kWh of power with government subsidies, each family's heating costs decreasing by 500 RMB.[74]

However, the immense governmental pressure on its finance brought by electric central heating is embodied not only in subsidies to people's electric bills but also electric network transformation. Based on the report of the National Bureau of Energy, the circuit length will reach 1,010 thousand km in about five years at least, with the cost approaching 2,000 billion RMB if the grid transformation for central heating is comprehensively implemented in China.[75] Taking Beijing as an example, the local government will need to transform 21,000km of electric lines and install more than 3,600

[73] "Electricity project is not only clean but also economical", China Daily, 1-4-2016, http://paper.people.com.cn/rmrb/html/2016-01/04/nw.D110000renmrb_20160104_1-14.htm

[74] "How to adopt right measures to prompt the coal to electricity project?", XRB.COM,2/4/2017, https://baijiahao.baidu.com/po/feed/share?wfr=spider&for=pc&context=%7B%22sourceFrom%22%3A%22bjh%22%2C%22nid%22%3A%22news_3238094997687919369%22%7D

[75] "5 years to rebuild the State Grid Corporation of China", RNERGY,9-1-2015, http://www.wusuobuneng.cn/archives/23118

transformers, 7.5 telegraph poles, and 68,000 ammeters if electric central heating is popularized in Beijing.[76] It requires a long time and is a big challenge for the government regarding financing.

The main stakeholder of compulsory desulfurization equipment installation required by the government is enterprises. The figures provided by the National Ministry of Environmental Protection show that there are 620 thousand coal-fired industrial boilers in China presently, which accounts for about 85% of the whole boilers, with their annual coal consumption reaching more than 700 million tons.[77] The emission proportion of their dust, sulfur dioxide, and nitrogen oxide separately accounts for 32%, 26% and 15% in the whole country, making them the main reason for haze and the management difficulty[78] Firstly, the transformation costs of coal-fired industrial boilers are enormous. It is estimated by the Ministry of Environmental Protection that the total transformation costs of small boilers below 10t/h are between 160 billion RMB and 200 billion RMB while the expenses of those under 10t/h are between 160.8 billion RMB and 206.7 billion RMB.[79] Secondly, the huge costs will bring much pressure to enterprises, among which those illegal companies will face fines between 100 thousand RMB and 5 million RMB based on the proposal, which may seriously sap their enthusiasm and cause an adverse impact on the increase of their profits. Research shows that the installation costs of desulfurization equipment are about 2.4 million RMB, even more than that of boiler equipment.[80]

[76] "The heating costs of villages in Beijing are lowered by the coal to electricity project", Beijing Securities, 1-6-2017, http://www.bjzq.com.cn/dpfx/News/201701/20170106084216_912339_2.html

[77] "China will strictly control the pollution caused by coal-fired industrial boilers", Xinhua Daily, 4-13-2014, http://news.xinhuanet.com/2014-04/13/c_1110219120.htm

[78] "China will strictly control the pollution caused by coal-fired industrial boilers", Xinhua Daily, 4-13-2014, http://news.xinhuanet.com/2014-04/13/c_1110219120.htm

[79] "The market capacity calculation of China's coal-fired boiler reform", Chyxx, 10-23-2015, http://www.chyxx.com/industry/201510/351723.html

[80] Wang Changyao, "Considerations of environmental protection alteration and heating costs", Cnenergy, 11-11-2015, http://www.cnenergy.org/yw/201511/t20151111_228991.html

Coal enterprises are much likely to oppose this proposal which however benefits electric power businesses. The government formulates tax laws to levy a tax on coal, the main stakeholder of which is Chinese coal enterprises. According to a report released by the Ministry of Environmental Protection in July 10, 2014, each ton of coal's external costs in China were 204.76 RMB, the equivalent of 28% of the coal price.[81] Among them, the costs of public health losses and mine workers' health damages caused by coal-fired air pollution are respectively 211.7 billion RMB and 93,400 million RMB, which account for 55% of the total external costs.[82] The number of China's raw coal exploration were respectively 320 million tons, 387 million tons, 413 million tons and 399 million tons from 2009 to 2012.[83] As the main coal production country in the world, China's coal production accounts for 40% in the world.[84] Moreover, as the main energy, coal plays an important role in China's economic development. The total contribution rates of GDP and its increments in China's coal production and main coal utilization industries are separately 15% and 18%.[85] For example, the coal production quantity of Inner Mongolia Province ranks first in China, and coal accounts for 11% in the province's GDP.[86] Shanxi Province is a significant coal production base in China and as the main industry of Shanxi province's economy, its coal industry influences about 40 % of the whole province's GDP directly and indirectly.[87]

[81] "The external environmental costs per ton of coal reach 204.76 RMB", CBH, 7-22-2014, http://www.qlwb.com.cn/2014/0722/170687.shtml

[82] "The external environmental costs per ton of coal reach 204.76 RMB", CBH, 7-22-2014, http://www.qlwb.com.cn/2014/0722/170687.shtml

[83] "The economic influence brought by tax on coal", Thesis Network, 9-1-2014, http://www.xzbu.com/2/view-6135369.htm

[84] Ma Jian, Ding Rijia, "The status of coal enterprises in the national economy and social development", Coal Technology, Jun, 2007.

[85] Xie Heiping, Liu Hong, Wu Gang, "The quantitative analysis of coal's contribution to the national economic development", Academician Speech, Apr 2012.

[86] "Being the major coal province, Inner Mongolia's coal rate accounts for 11% in its GDP", Coal Safety, 3-9-2016, http://www.mkaq.org/html/2016/03/09/354593.shtml

[87] Xin Hongbo. The impact analysis of the coal resources taxation according to price on the coal industry [J]. Coal Economic Research, 2013(8).

A 10% energy tax on coal will necessarily strike the current management of coal industry, adding to enterprises' revenue burden. The sharply decreased profits of coal companies, despite restrained coal consumption, will simultaneously cause the increased unemployment rate of the industry, to which the government should pay attention. According to the statistical data by the State Statistics Bureau, the number of employee in China's coal industry in 2014 and 2015 were respectively 6,113 thousand and 4,424 thousand.[88] Thus, it is clear that the coal industry creates many job opportunities, and a massive layoff in this industry will decrease employment rate and social instability to a certain degree, which must also be stressed by the government. Also, the lowered profits of coal businesses will reduce local governments' financial revenues and slow down local provinces' development. Consequently, it is possible for the local governments to oppose this proposal either.

[88] China's National Bureau of Statistics, China Statistical Yearbook.

Recommendation

Despite the fact that my proposals, such as the use of central heating, penalties, and tax levies, might put pressure on the government and possibly increase the unemployment rate or reduce the GDP, my suggestion for the proposal remains resolute because it has more advantages than disadvantages.

Firstly, central electric heating can indeed help improve the air quality in China. According to a research study, Beijing burned 23 million of coal in 2012, representing 25% of total energy consumption, in which domestic coals (coals without processing which will yield high pollution) accounting for 17%. If the transition to electric heating were implemented, then haze and fog would be largely mitigated. Meanwhile, the transition can also help reduce air pollutants. A researcher says that, if the transition is fully implemented in Beijing in 2017, then 3 million tons of CO_2, 27,900 tons of SO2, and 8,100 tons of nitrogen oxides will be reduced.

Secondly, I also suggest installing desulfurization facilities for all industrial coal-burning boilers and implementing penalties for deceitful enterprises, which will contribute to reducing industrial pollutants. According to *2011 Journal of China's Environment*, industrial heating coals form a major part of the totally 24.043 million nitrogen oxides pollution with 17.295 million. According to the media, in June 2011, 10 million tons of SO2, 2 million tons of nitrogen oxides, 1 million tons of dust, 90 million tons of waste were emitted by industrial coal-heating boilers in China. Despite the high cost of implementing desulfurization facilities, doing so would cultivate long-term benefits for not only the environment but also enterprise regarding upgrading technology.

Thirdly, to levy a tax on energy is to deal with the pollution from the very beginning. Coals are major energy resources in China. According to the statistics, coal consumption accounts for almost 70% of the production and consumption of primary energy, far more

than the average ratio of that in developed countries. Coal consumption in China was already at 50.3% of the proportion of global coal consumption, and that is 4.2 times of that of the US and 6.7 times of that of the EU. By levying energy tax, coal price will be raised, and the consumption of both domestic and corporate use will shift to cleaner energy such as natural gas and electric power, to reshape China's energy structure. Indeed, doing so would reduce inevitably reduce the profit for enterprises and would lower the employment rate in this industry. However, it will also boost the development of clean energy and renewal energy in China.

China's fog and haze issue is no longer just an environmental one. It is already posing threats to our citizens' health and even troubling transportation. The happiness of the general public has suffered, and the government's credibility has been diminished. I believe, the soundness of people's mental as well as physical health and their happiness should never lose ground the economic development. It is also the governments' bounded duty to provide for the general public a clean and healthy development, and that is exactly why I suggest the adoption of the three proposals. On the other hand, governments, enterprises as well as the general public, which are all stakeholders in governing the pollution, should work in synergy to deliver results that benefit all. The governance of fog and haze cannot be accomplished overnight, and it might take several years or even decades to reach the target. What we should do is take immediate action, and this proposal is the first step.

Curriculum Vita

Bingshuo Liu was born in Tianjin of China and is now living in Vienna of Virginia. He acquired a degree of Bachelor in Finance in China and, had since, then worked as a bank teller for two years in Agricultural Bank of China Tianjin Branch. He had a strong interest in politics and history and was enrolled in Johns Hopkins University to study public management. Tianjin, the city he lived in, was inflicted with serious fog and haze. For that reason, he had made up his mind to choose *the governance of fog and haze in China* as the topic of his capstone project, in the hope of making his own contribution to the governance of air pollution in China. Finally, he wishes to pay great tribute to his instructor as well as his parents for their support.